SF 298 MASTER COPY KEEP THIS COPY FOR REPRODUCTION PURPOSES

REPORT DOCUMENTATION PAGE

Form Approved
OMB NO. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
		Technical Report

4. TITLE AND SUBTITLE

Title on Technical Report

5. FUNDING NUMBERS

DAAH04-93-G-0505

6. AUTHOR(S)

Author(s) listed on Technical Report

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(ES)

Sam Houston State Univ.
Huntsville, TX 77341-2116

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Research Office
P.O. Box 12211
Research Triangle Park, NC 27709-2211

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

ARO 32482.1-CH

11. SUPPLEMENTARY NOTES

The views, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other documentation.

12a. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

12 b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

Abstract on Reprint

14. SUBJECT TERMS

15. NUMBER IF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OR REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18
298-102

WORKING PAPER

No. 95-19A

September 1995

HOW MUCH DOES IT REALLY COST TO BE GREEN? THE NEED FOR AN ENVIRONMENTAL COST CLASSIFICATION SYSTEM

by

Ross Quarles, Ph.D., CPA
Associate Professor of Accounting
Sam Houston State University

The Working Papers series is published periodically by the Center for Business and Economic Development at Sam Houston State University, Huntsville, Texas. The series includes papers by members of the faculty of the Colleges of Business Administration reporting on research progress. Copies are distributed to friends of the Colleges of Business Administration. Additional copies may be obtained by contacting the Center for Business and Economic Development.

ABSTRACT

This study examines the critical issues related to the identification and classification of environmental expenditures by business organizations. The recently developed EPA environmental cost classification scheme is reviewed and a number of potential shortcomings of that system are identified. This study proposes an alternative environmental cost classification system based on the concepts of Activity Based Costing. This activity based system overcomes many of the potential shortcomings of the EPA system and may be more useful for internal management decision making regarding the nature and extent of environmental expenditures.

Introduction

The ongoing debate regarding the relationship between business and the environment is marked by two conflicting arguments: (1) expenditures for environmental improvements may be the best way to increase the firm's efficiency and profitability and (2) environmental costs are skyrocketing with little economic payback in sight.[1] Michael Porter argues that as companies re-engineer their technology to reduce pollution they will also lower the firm's costs as well.[2] Walley and Whitehead describe the opposing view that pursuit of ambitious environmental goals may impose economic costs that exceed the book value of the firm.[3] Although these positions are based on differing views of the effects of environmental costs and expenditures on a firm, both sides in this debate hold a common belief that environmental costs can be validly and fully measured. However, the problems that existing accounting information systems have in accumulating environmental costs invalidate this assumption of full environmental cost measurement. Therefore, any debate over the effects of environmental expenditures on a business organization is moot without a valid measure of a firm's full environmental costs.[4]

In recent case studies of business firms that have established tracking systems for environmental costs, reported environmental costs range from as low as 3.2% of manufacturing cost to a high of 22% of operating costs. Although this wide range of costs may accurately represent valid differences in environmental costs across the firms, it may also be driven by differences in the accounting information systems used. Traditional accounting information systems do not necessarily provide comparable information regarding full environmental costs either across firms or possibly even within a particular firm, and, thus, provide managers with distorted views of full environmental costs.[5]

The fundamental difficulty in measuring full environmental costs comes from the absence of a means to specifically define and classify the firm's costs incurred to achieve environmentally driven objectives.[6] Traditional general-ledger-account driven cost classification schemes do not allow identification of the full costs incurred in pursuing specific environmental objectives.[7] Therefore, as indicated by Walley and Whitehead, one of the first tasks necessary in addressing environmental costs is to understand how much is being spent and why. Designing a firm's accounting information system to identify "**how much**" and also "**why**" for the firm's full environmental costs is a necessary step in that process of understanding. Without a workable system for identifying and classifying environmental expenditures, any management decisions regarding those expenditures may lack sufficient cost information.

This paper identifies and discusses the problems of traditional accounting information systems in measuring full environmental cost, describes an environmental cost classification system recently proposed by the EPA to address those problems, identifies a number of potential problems with the EPA system, and describes an alternative system to the one offered by the EPA.

Problems with Traditional Accounting Information Systems

Two sources of distortion in measuring full environmental costs through a traditional accounting information system are (1) the treatment of environmental costs incurred as part of manufacturing overhead and (2) the reporting of cost data using traditional general ledger classifications rather than the nature of the environmental activities accomplished.

The Manufacturing Overhead Problem

Some activities necessary for compliance with environmental laws and regulations are carried out by overhead functions that support operations or manufacturing. Traditional accounting information systems may obscure these compliance costs by treating them as manufacturing overhead or general and administrative costs.[8] If these costs are treated as overhead, they are usually arbitrarily allocated to products and/or processes independently of their environmental

impact or importance. If they are treated as general and administrative expenses, these costs are not included as part of product costs.

For example, in a function such as cleaning the factory building, cleaning personnel may have altered their activities and tasks to comply with environmental laws and regulations. Prior to environmental considerations becoming a concern in their daily activities, cleaning personnel may have expended little effort in activities such as selecting the types of solvents and materials used, properly disposing of cleaning materials, or participating in hazardous waste training. While these newly critical tasks are environmentally driven and their costs are environmental costs, the traditional accounting information system classification scheme records these costs as building cleaning and charges them to products (or processes) based on derived overhead rates. Thus this practice does not provide management with any indication that these costs are part of the firm's full environmental cost of operations or manufacturing. This situation is true in all overhead functions of a firm. Environmental laws and regulations apply to all of the functions in a firm, regardless whether those functions directly involve manufacturing or operations or whether they are overhead. Therefore, unless the accounting information system identifies all environmentally driven costs, the full environmental cost incurred in all firm activities is difficult to determine.

One way to address the environmental overhead problem is to identify environmental cost drivers and charge out overhead based on cause and effect relationships between costs and activities.[9] This approach highlights the need for a system that identifies and classifies overhead environmental costs and the related factors such as cost drivers, activities, and objectives.

Absence of an Identification of Environmental Cost Activities

In order to support traditional financial reporting, accounting systems generally report data in terms of general ledger accounts and organizational locations. While this data may be reaggregated or rearranged for internal managerial reporting and analysis, usually in neither financial nor managerial reporting are the full costs of environmental activities specifically aggregated and reported. Although a firm may be engaged in environmental activities such as

prevention, disposal, cleanup, and detection, it is generally impossible to accurately determine the full amount of expenditures on each particular activity. This absence of specific cost data for these types of activities is a serious concern when one considers that only activities that can be seen or measured can be managed. A reporting system based on traditional general ledger cost classifications or on organizational locations does not have the capacity to produce the visibility necessary for full environmental cost management.

Addressing the Problems of Traditional Accounting Information Systems

A first step in facilitating the aggregation and reporting of full environmental cost is the development of a system that classifies the costs of activities based on environmental objectives. This system would allow managers to identify and classify what activities are provided by different types of environmental expenditures regardless of the organizational units where the expenditures are incurred. This would allow management to better understand and manage environmental activities and costs as well as address issues such as tradeoffs between types of expenditures. In spite of the costs associated with developing this system the increased levels and importance of environmental expenditures make such a system necessary.[10]

The EPA Environmental Cost Classification System

Recently, the EPA announced a cost classification system to help overcome the shortcomings of traditional accounting information systems and provide management with improved full environmental cost information. The EPA suggests several reasons why this improved information would be of interest to management.

1. Environmental costs may be reduced or eliminated as the result of favorable business decisions (e.g., investment in "greener" technology, redesign of products/processes).
2. Non-value added activities (e.g., wasted raw materials) may be eliminated.
3. Actual levels of environmental costs may be obscured in overhead accounts and not fully understood.
4. Environmental costs may be offset to a degree by generating revenues from sale of wastes or byproducts.
5. Better environmental management may benefit human health and business success.

6. Understanding environmental costs may promote more accurate product costing and pricing as well as aid in design of more environmentally preferred products and processes.
7. Competitive advantage with environmentally conscious consumers may be improved.
8. Identification of environmental costs may support an overall environmental management system that may be a necessity in cases where proposed ISO 14001 requirements apply for international trade.[11]

The EPA system identifies a number of major categories of environmental costs: (1) Conventional Costs, (2) Potentially Hidden Costs, (3) Contingent Costs, and (4) Image and Relationship Costs. A summary of the specific costs included in each of these categories is shown in Figure 1.

Conventional Costs

Conventional Costs include materials, labor, supplies, equipment, and buildings used to produce products or to operate processes. These costs are generally not considered to be environmental in nature and their environmental effects are not recorded by traditional accounting information systems. Conventional Costs seem to be those addressed in the Porter and Walley/Whitehead debate regarding the effects of environmental expenditures on the firm. These costs include items such as emission control equipment, waste water treatment facilities, and disposal equipment and facilities. Although readily identified as environmental costs, Conventional Costs represent only one factor of the full environmental costs at issue. Thus, debates about environmental expenditures that include only Conventional Costs ignore a large body of less visible environmentally driven costs.

Potentially Hidden Environmental Costs

The EPA system identifies four types of costs as Potentially Hidden Environmental Costs: (1) Upfront Costs, (2) Regulatory Costs, (3) Back-end Costs, and (4) Voluntary Costs. Upfront Costs are those incurred prior to the operation of the process, system, or facility in question. These preacquisition or preproduction costs relate to activities like siting, product and process

design, supplier qualification, and evaluation of alternatives. The traditional accounting information system may obscure Upfront Costs by classifying them as R&D, total facility cost, and legal or professional fees.

Regulatory Costs are incurred in operating the process, facility, or system and include the costs of tasks such as reporting, monitoring and testing, training, inspecting, labeling, spill response, and remediation. They include costs incurred to comply with federal, state, and local environmental laws and regulations during the operation of the process or facility. These costa are generally recorded as part of manufacturing overhead or as G&A expense.

Back-end Costs reflect prospective future environmental costs that include costs of tasks such as closure, decommissioning, inventory disposal, cleanup, and post-closure care and monitoring. Back-end Costs arise at the end of the useful lives of the products, processes, or facilities and may be considered as the costs necessary to "exit" from the situation. Although there may be a high level of certainty that these costs will be incurred, they are not recorded by the accounting information system because of the inability to "accurately" measure such costs.

Voluntary Costs represent expenditures in excess of those required for statutory compliance and involve costs such as community relations and outreach, recycling, and support of environmental groups. If a firm incurs these costs, the accounting information system generally classifies them as overhead or general and administrative expense.

Contingent Costs

Environmental Contingent Costs are those that might be incurred in the future. Although these costs are uncertain (because they are based on future events), probabilities are associated with them. Examples of these costs are those associated with accidental spills or releases, fines and penalties due to future regulations, and unanticipated future costs associated with currently permitted treatment or disposal. Contingent Costs are the "contingent liabilities" or "environmental liabilities" associated with current operations of the firm. Since these costs are generally not

recognized or recorded in traditional systems, they may not be considered by management as environmental costs.

Image and Relationship Costs

Image and Relationship Costs are those related to the subjective perceptions of all interested stakeholders (customers, communities, regulators, employees, management, owners, etc.) concerning the environmental standing of the firm. The costs address the firm's environmentally related image and its relationship with these stakeholders. While the benefits of such costs may be intangible, the costs incurred to obtain those intangible results are real. Given that many of these costs are included in overhead or general and administrative functions, their environmental aspects may not be identified in a traditional accounting information system.

Potential Difficulties with the EPA System

There are a number of problems that may affect the application of the EPA environmental cost system to business operations. First, the system is driven by the concept of time; that is, the costs are generally classified based on when they occur in the environmental management cycle. In the system, Upfront Costs are preacquisition, preproduction, or early development expenditures. Back-End Costs address the end of the cycle with "exit" considerations such as closure, decommissioning, and cleanup. Regulatory Costs and Voluntary Costs, although they may be incurred at any time, are primarily directed toward the operational or current-time portion of the time cycle. Contingent Costs and Image and Relationship Costs are future oriented. Therefore, if management is tied to a time driven decision process, this taxonomy supports environmental decision making. However, some managers may be concerned with the objectives of costs (i.e., the "why" of the expenditures) rather than the point in time or in the environmental management cycle when the costs occur. This orientation toward cost objectives (i.e., the "why" consideration) is driven in part by many recent management innovations such as Total Quality Management, Activity Based Costing, and Activity Based Management.

A second problem is that the EPA system establishes categories of environmental costs that are not mutually exclusive. For example, the EPA system classifies the costs associated with the task of remediation as Regulatory Costs, as Voluntary Costs, and as Contingent Costs. If management is concerned with the total costs of remediation, then those costs are spread across three classifications based on when they occur. Also, training is classified as both a Regulatory Cost and as a Voluntary Cost, but is not classified as an Upfront Cost. Managers may consider training as an Upfront Cost given that training personnel to operate a new plant or process is a preproduction-type expenditure. Additionally in regard to training, the EPA system appears to adopt a somewhat pessimistic view as to why a firm incurs costs for the environmental training. By requiring that training costs be classified only as Regulatory Costs or as Voluntary Costs, the EPA system appears to address training solely as a regulatory or as a community perception issue, with little consideration that a firm might conduct training to actually prevent or to actually correct adverse environmental incidents regardless of regulations or public relations.

A third problem with the EPA system is that it includes both regulatory driven costs and operationally driven costs within each of its classification categories. If only the total cost in each category is examined, then it is impossible to determine how much of that cost is due to regulatory tasks and how much is due to operational tasks. For example, Upfront Costs include both permitting and site preparation costs for a new plant. Permitting is a regulatory task, but the preparation of a plant site serves many business reasons, including prevention of adverse environmental consequences, regardless of regulatory requirements. Management may be interested in knowing that the total cost of a new plant site consists of 60% permit acquisition costs and 40% site preparation costs. Classifying both costs as Upfront Costs may obscure that particular regulatory versus operational split. Under the EPA system, Regulatory Costs include costs of regulatory driven tasks such as notification, reporting, and recordkeeping and also operational tasks such as inspections, spill response, pollution control, and waste management. By "mixing" the costs of both regulatory driven and operationally driven tasks within each

category, the EPA system may obscure information that management may find useful in decision making.

Finally, the EPA system does not focus attention on potential tradeoffs between types of environmental expenditures. Potential environmental cost tradeoffs include tradeoffs between prevention and cleanup, between prevention and disposal, or between disposal and cleanup. For instance, a relatively small expenditure on prevention may lead to a substantial savings in disposal or cleanup costs. These potential tradeoffs are not readily apparent when costs are classified as Upfront, Back-end, or Voluntary costs. As indicated by Porter, the "right" kind of environmental regulations will stress such activities as pollution prevention rather than merely abatement or cleanup.[12] If the EPA cost classification system does not focus management attention on the tradeoffs possible between activities such as prevention and cleanup, than such a system may not be the "right" system to use for classifying environmental costs.

An Activity Driven Environmental Cost System

One alternative to the EPA's time driven environmental cost classification system is a system based on the concepts of Activity Based Costing (ABC). Under the concepts of ABC, activities are considered to be the types of work performed in order to achieve a particular objective. Within each type of activity, specific tasks are accomplished in order carry on those activities. By grouping the costs of tasks by activities rather than by organizational locations, management can observe the costs of the activities necessary to achieve a given objective.

Under an activity driven environmental cost classification system, the objective of all environmental activities and their related expenditures may be considered to be compliance in its broadest sense. From one perspective, compliance involves adherence to federal, state, and local laws and regulations concerning operations and reporting. Compliance may also be driven by internal considerations regarding the firm's image, relationship to stakeholders, or even genuine concern for the environment. Given the objective of compliance, the cost elements of an activity driven system are the costs of environmental activities performed to meet that objective. This

system uses the following categories to aggregate and classify the costs of environmentally driven activities:

Preventive Costs **Detective Costs** **Corrective Costs**

Disposal Costs **Reporting Costs**

The various costs included in these categories are shown in Figure 2.

Preventive Costs

Environmentally driven Preventive Costs are incurred to prevent or minimize adverse environmental impacts or non-compliance with regulatory requirements. These costs are the costs of proactive steps taken in producing the product or operating the production process. For example, in the design of a product certain potential components may have differing degrees of adverse environmental impacts. If design engineers are aware of these impacts and design the product to include components with the least or no adverse environmental effects, then the cost of the incremental effort involved in developing that design is an environmentally driven Preventive Cost. If production management designs production operations to minimize or eliminate adverse environmental impacts (e.g., using environmentally benign solvents) then the cost of these efforts represents environmentally driven Preventive Costs. Preventive Costs also include the costs of emission control equipment, environmentally secure storage facilities, secondary containment facilities, hazardous material training, container labeling, waste collection equipment, and proper container design and construction. Preventive Costs may be directly involved in the production process, or they may be incurred in overhead functions involving such tasks as vendor research, identification of regulatory requirements, employee training, inventory control and storage, and facilities design and maintenance.

Preventive Costs occur at different times during the environmental management cycle. The cost of site studies or modeling to aid in the prevention of adverse environmental consequences

occur as part of a preproduction or preacquisition phase. Preventive measures such as pollution control, training, inspections, labeling, and supervision occur during current operations. These costs may also be part of the closure or decommissioning costs necessary to exit from the situation (e.g., post-closure care to prevent accidental spills or fugitive emissions).

Detective Costs

Environmentally driven Detective Costs are incurred to determine if an adverse environmental event has taken place. These costs are a "second line of defense" to deal with potential adverse environmental events that cannot be fully prevented. Detective costs represent the costs necessary to detect or discover events such as fugitive emissions, accidental leaks or spills, unstable conditions, or creation of hazardous conditions. These costs involve the acquisition, installation, use, and maintenance of equipment for monitoring and sampling (e.g., alarms, gauges, inspections, tracking systems, analyses of waste materials, and testing). Detective costs include hiring technical personnel with the abilities necessary to provide adequate expertise to monitor the operations of the firm for adverse environmental events. These costs also include training employees to operate monitoring equipment and/or to act as monitors for spills, emissions, or unstable conditions.

Detective Costs may occur at various stages in the environmental management cycle. During current operations, the costs of monitoring and testing, auditing, and medical surveillance address detection of adverse situations. During preacquisition or preproduction activities, Detective Costs are incurred in the development, selection, and installation of devices to monitor operations of the facility or process. Therefore, the acquisition costs associated with these detective and monitoring devices are part of Detective Costs even though they occur prior to the beginning of operations. In the exit or closure phase of the environmental management cycle, Detective Costs are incurred in the monitoring, testing, and surveillance tasks associated with post-closure care.

Corrective Costs

Environmentally driven Corrective Costs are incurred in providing for the restoration and cleanup of environmental wastes and problems either from long time operations or from current events such as spills, releases, or accidents. These costs involve tasks such as rehabilitation and recovery as well as the costs of mitigation or containment of adverse environmental events. Corrective Costs include the costs of direct intervention activities such as containment or cleanup as well as less direct activities such as contingency planning and training, emergency response planning, and environmental impact assessment. Given that Corrective Costs are incurred in response to an event or condition that could occur at any time, these costs may be incurred during any phase of the environmental management cycle.

Corrective Costs present a sensitive problem for management because they may be incurred for cleanup or restoration necessary due to either to past or current operations or products. If Corrective Costs represent costs of dealing with inherited transgressions, to what degree should current operations, products, and management be held budgetarily responsible for those costs? Although the firm as a whole is accountable for the costs of correcting problems, current products and management should not necessarily be held directly responsible for the costs incurred to correct those past events.

Disposal Costs

Environmentally driven Disposal Costs are incurred in providing the final disposition of products, materials, wastes, and packaging from the firm's point of view. These costs involve direct actions by the firm to dispose of the items (e.g., the cost of incineration or discharge) or delivery to an approved waste management facility. Included in this category are the costs such as incinerating or transporting wastes, obtaining permits and discharge fees, and the analyses of products and raw material to determine any disposal hazard that they may represent. These costs also include employee training for disposal, waste identification and labelling, separation of types

of wastes, and the costs of facilities and equipment to transfer or dispose of wastes. Reclamation and recycling efforts may sometimes reduce Disposal Costs.

Although disposal is generally considered to be an issue at the end of the environmental management cycle, management should view disposal as an activity that requires performance of tasks at varied times during the cycle. The eventual disposal of the materials, product, equipment, and wastes produced by the firm is a pertinent issue in the early planning stages, in current operations, and at the end of the cycle. For example, the costs of disposing of packaging materials in which suppliers ship components or raw materials should impact the processes of vendor selection, material management, product component selection, and production process design.

Reporting Costs

Environmentally driven Reporting Costs are incurred to prove compliance with the various environmental regulatory requirements that affect the firm. These costs include the costs of permit acquisition, environmental assessment and impact studies, legal fees, and waste processing applications as well as the cost of any recordkeeping to ensure that compliance can be validated. The direct costs of preparing reports such as discharge monitoring reports, materials usage reports, spill or accidental emission reports, and employee training reports are also classified as Reporting Costs. Reporting Costs also involve the costs of developing the data collection systems necessary for recording and reporting compliance. Reporting Costs, therefore, occur at various stages in the environmental management cycle (e. g., the necessary permitting in conjunction with site selection and preparation; the notifications, recordkeeping, and reporting required by current operations; the information necessary to support claims of voluntary compliance; or the reports, permits, site surveys, etc. necessary for closure or exit).

Reporting Costs address the issues of accountability, validation of regulatory compliance, and recordkeeping regarding environmental issues and considerations. Classification of these costs into a category separate from the costs of operational activities allows comparison of the costs of recordkeeping and reporting with the costs of operational activities. A firm that has a high level

of environmental cost may find that a disproportionately large portion of that cost involves recordkeeping rather than direct environmental actions. In such a case the interested parties may decide to reduce reporting costs and increase expenditures on direct actions.

Comparisons of the EPA and the Activity Based Systems

A firm may choose either the EPA time driven system or an activity based system to classify and aggregate environmental costs. One criteria for making the choice may be the degree to which each system provides information useful to management for decision making.

An activity driven system distinctly identifies the linkage between an expenditure and the particular environmental objective (e.g., prevention, detection, correction) that the expenditure supports. This linkage provides an accurate indication as to how much is being spent on each type of environmental activity, regardless of when the expenditure may occur in the environmental management cycle. The linkage also ensures that any tradeoffs in expenditures between types of environmental activities are clearly evident.

Under the EPA system, the absence of a distinct linkage between an expenditure and its specific environmental objective may result in suboptimum business decisions. For example, under the EPA system, the cost of cleaning up a raw materials storage area necessitated by long-past operations is added to the cost of current activities such as pollution control, environmental training, and monitoring to determine total Regulatory Cost. A profit center manager charged for this total Regulatory Cost might be prompted to reduce or eliminate current activities such as training or monitoring to offset the cost of the required cleanup. In the long run, the reduction of current expenditures on training or monitoring may produce an even larger environmental problem for the firm than that of the raw materials area cleanup. Under the EPA system, however, the reduction in training and monitoring costs in favor of cleanup costs would not be evident -- the total Regulatory Cost would remain constant. Under an activity based system, with the costs of the cleanup classified as Corrective Costs and the costs of training and monitoring classified, respectively, as Preventive Costs and Detective Costs, expenditures related to these differing

environmental objectives would be specifically identified and any changes in their levels immediately discernable.

By including both reporting and operational activities within the same category (Regulatory Costs) the EPA system does not address the different degrees of control that management has over those two sets of activities. The level of expenditures for recordkeeping and reporting is heavily dependent on regulatory reporting requirements mandated by external parties and largely unaffected by management decisions. On the other hand, the cost of an operational activity such as waste management is primarily affected by management's actions. Under an activity based system, regulatory mandated recordkeeping and reporting costs related to waste management are classified as Reporting Costs and the costs of active waste management activities are classified as Disposal Costs. This latter arrangement provides a better indication of the differing degrees of control that management has over these two types of expenditures.

The EPA system reflects a view that the environmental activities of a firm are driven almost exclusively by regulatory requirements. This view does not recognize that environmental activities may be driven by a firm's internally generated objectives. For example, although regulatory considerations may be the primary drivers of Regulatory Costs such as spill responses, waste management, environmental training, and preparedness, good business operating practices and/or the firm's desire to avoid problems with stakeholders other than regulators also drive these costs. By emphasizing a potentially myopic regulatory view, the EPA system appears to miss this point. While regulations may specify general requirements for activities such as toxic waste management, the actual management of toxic waste may involve either preventive activities (such as eliminating toxic components of products) or proper disposal of the toxic wastes. By classifying waste management solely as a Regulatory Cost, the EPA system fails to recognize alternate activities that can be used in the process of waste management. In this particular case, failure to recognize the potential preference of prevention over disposal may result in an increased adverse impact on the environment. An activity based system overcomes this weakness by identifying the levels of expenditures on alternative activities such as prevention and disposal and focuses management

attention on the potential savings, in cost to the firm and to the environment, that prevention versus disposal may afford.

Conclusion

To improve its decision making process, the management of a firm needs to augment its traditional accounting information system to specifically identify and measure environmental costs. This requires a classification system that (1) minimizes ambiguity regarding environmental costs, (2) identifies linkages between environmental objectives and costs, (3) identifies potential tradeoffs between types of environmental expenditures, (4) addresses differing degrees of management control over environmental expenditures, and (5) focuses management attention on the critical issues involved. Before debating whether environmental expenditures are beneficial or detrimental to a firm, there must be a means for measuring the firm's actual, full environmental cost. The development of a system for classifying environmental costs so that they can be fully measured, understood, and managed is a critical "next step" in this process.

Figure 1
EPA Environmental Cost Classification System
[source EPA 1995]

Potentially Hidden Costs

Conventional Costs	**Upfront Costs**	**Back-End**
Capital equipment	Site studies	Closure
Materials	Site preparation	Decommissioning
Labor	Permitting	Disposal of inventory
Supplies	R&D	Post-closure care
Utilities	Engineering	Site survey
Structures	Procurement	
Salvage Value	Installation	

Regulatory Costs	**Voluntary Costs**
Notification	Community relations
Reporting	Community outreach
Monitoring/testing	Monitoring/testing
Training	Training
Studies/modeling	Audits
Remediation	Remediation
Recordkeeping	Qualifying suppliers
Plans	Reports
Inspections	Landscaping
Manifesting	Planning
Labeling	Feasibility studies
Preparedness	Recycling
Protective equipment	Environmental studies
Medical surveillance	R&D
Taxes/fees	Insurance
Financial assurance	Habitat protection
Pollution control	Wetland protection
Spill response	Financial support to environment groups and researchers
Stormwater management	
Waste management	
Environmental insurance	

Contingent Costs

Future compliance costs	Remediation	Legal expenses
Penalties/fines	Property damages	Natural resource damages
Responses to future releases	Economic loss damages	
	Personal injury damages	

Image and Relationship Costs

Corporate image			
Relationships with:	customers	investors	lenders
	suppliers	regulators	insurers
	workers	host communities	
	professional staff		

Figure 2
An Activity Based Environmental Cost Classification System

Preventive Costs		
Training	Studies/modeling	Plans
Labeling	Testing	Manifesting
Site survey	Preparedness	Pollution control
Site studies	Site preparation	R&D
Materials selection	Qualifying suppliers	Engineering
Procurement	Feasiblilty studies	Environmental studies
Habitat protection	Wetland protection	Installation
Structures	Materials	Impact analysis
Product design	Process design	Materials selection
Maintenance	Materials storage	Repairs
Detective Costs		
Monitoring	Inspections	Audits
Capital equipment	Labor	Sampling
Medical Surveillance		
Corrective Costs		
Remediation	Protective equipment	Environmental insurance
Spill response	Penalties/fines	Property damage
Personal injury damage	Legal expense	Natural resource damage
Economic loss damage	Containment	Emergency response plan
Emergency planning	Cleanup	Root cause analysis
Damage assessment		
Disposal Cost		
Sorting materials	Hazard analysis	Pollution control
Waste management	Disposal fees	Stormwater management
Closure	Decommissioning	Post-closure care
Recycling	Emission control	Discharge fees
Capital equipment	Disposal of inventory	Transportation
Collection	Deactivation	Waste treatment
Incineration	Hazardous waste classification	
Reporting Costs		
Notification	Reporting	Recordkeeping
Permitting	Waivers	Negotiations
Legal research	Regulation monitoring	Licenses
Filing	Certifications	
Information system development		

1 See Noah Walley and Bradley Whitehead, "It's Not Easy Being Green," *Harvard Business Review,* May-June 1994, pp. 46-51.

2 Michael Porter, "America's Green Strategy," *Scientific American*, vol. 264, April 1991, p. 168.

3 Walley and Whitehead, *Harvard Business Review*, 1994.

4 The identification of environmental costs has consequences for national income accounting, for financial accounting, and for business managerial accounting. This study focuses on the last of these areas, managerial accounting and the way that area relates to management's decision making processes. In addition, environmental costs may be interpreted to include not only the costs that directly impact the particular organization (i.e., the private costs) but also involve costs to individuals, society, and the environment (i.e., the public or societal cost). This study addresses only the private costs that directly affect the firm's bottom line.

5 See Daryl Ditz, Janet Ranganathan, and Darryl Banks, editors, *Green Ledgers: Case Studies in Corporate Environmental Accounting*, (Baltimore, MD: World Resources Institute, 1995).

6 An environmental cost classification system does not replace the traditional accounting information system but augments that system by providing a means for addressing environmental issues through reaggregation and reporting of currently existing accounting data.

7 The term "full costs" in the management accounting context means the allocation of all direct and indirect costs to a product or product line for inventory valuation, product pricing, and profit determination. [Institute of Management Accountants, *Statement on Management Accounting No. 2A*, 1990]

8 For example see Burt Hamner and Christopher Stinson, "Managerial Accounting and Environmental Compliance Cost," *Cost Management*, Summer 1995, pp. 1-7 or Ditz, et. al., *Green Ledgers*, 1995.

9 Hamner and Stinson, *Cost Management*, 1995.

10 Hamner and Stinson, *Cost Management*, 1995.

11 U. S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, *An Introduction to Environmental Accounting As a Business Management Tool: Key Concepts and Terms*, EPA 742-R-95-001 (Washington, D.C.: U.S. Government Printing Office, June 1995).

12 Porter, *Scientific American*, 1991.